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Occupational moral injury and mental health: A systematic review and meta-analysis

Victoria Williamson[a*], Sharon A.M. Stevelink[a], Neil Greenberg[a]

[a] King's Centre for Military Health Research, King's College London, Weston Education Centre, 10 Cutcombe Road, London, SE5 9RJ

* Correspondence to: Dr Victoria Williamson

Kings Centre for Military Health Research, King's College London, Weston Education Centre, 10 Cutcombe Road, London, SE5 9RJ, UK

Tel: +44 0207 848 5347

Email: Victoria.williamson@kcl.ac.uk

Abstract

Background: Many people confront potentially morally injurious experiences (PMIEs) in the course of their work can which violate deeply held moral values or beliefs, putting them at risk for psychological difficulties (e.g. post-traumatic stress disorder [PTSD], depression, etc.).

Aim: To assess the impact of moral injury on mental health outcomes.

Method: We conducted a systematic review and meta-analysis to assess the association between work-related PMIEs and mental health disorders. Studies were independently assessed for methodological quality and potential moderator variables, including participant age, gender and PMIEs factors, were also examined.

Results: 13 studies were included representing 6,373 participants. PMIEs accounted for 9.4% of the variance in PTSD, 5.2% of the variance in depression, and 2.0% of the variance in suicidality. PMIEs was associated with more symptoms of anxiety and behavioural problems (e.g. hostility), although this relationship was not consistently significant. Moderator analyses indicated that methodological factors (e.g. PMIE measurement tool), demographic characteristics, and PMIE variables (e.g. military vs non-military context) did not affect the association between PMIE and mental health outcomes.

Conclusions: Most studies examined occupational PMIEs in military samples and additional studies investigating the impact of PMIEs on civilians are needed. Given the limited number of high quality studies available, only tentative conclusions about the association between exposure to potentially morally injurious events and mental health disorders can be made.

Keywords: Moral injury, PTSD, occupation, depression, suicidality, meta-analysis

Declaration of interest: None.

Introduction

Potentially morally injurious experiences (PMIEs), including "perpetrating, failing to prevent, bearing witness to, or learning about acts that transgress deeply help moral beliefs and expectations" [1] (p. 700) can result in significant psychological distress or moral injury[1]. Certain occupational groups may be at risk of exposure to work-related morally injurious events, including first responders, journalists, and armed forces personnel. Moral injury is often associated with strong moral emotions related to the event, including guilt, anger and disgust[2], and can lead to distress and psychological difficulties. For example, in combat veterans, PMIEs is significantly associated with post-traumatic stress disorder (PTSD), depression and suicidal ideation[2,3]. However, the psychological impact of PMIEs for those in non-military employment remains unclear. Most studies have exclusively examined moral injury in US armed forces personnel[4–7]. The few studies that exist indicate that those in non-military professions, such as police, can also experience moral injury following PMIE[8,9]. The aim of this review is to examine the mental health outcomes associated with occupational PMIEs. We also examined potential moderators of effects to determine whether these influenced the magnitude of the associations between PMIEs and mental health outcomes. Studies examining moral distress, which is similar to moral injury, in healthcare professionals find exposure to cause psychological distress and burnout[10,11]. As this concept has been extensively reviewed in recent years (e.g. [10, 11]), it was not included in the present study.

Methods

Search strategy

We conducted a computer based search in December 2016 of the following psychological and medical electronic literature databases: Embase, PsychNet, Medline, PsycInfo, PILOTS, Google Scholar, Web of Science. The search terms were related to moral injury, mental

health, and occupation (see Supplementary Table 1). In addition, key authors were contacted to request details of any further studies and reference sections of relevant review papers (e.g. [1,3,12]), book chapters and issues of journals (e.g. Journal of Traumatic Stress) were manually searched to identify any additional studies.

Eligibility criteria

Studies had to meet the following criteria to be considered for inclusion: a direct measure of exposure to PMIE incurred as a result of the participant's occupation; a standardised measure of mental health; and statistical testing of the association between PMIEs and mental health. Measures of exposure to potentially morally injurious events were included if they asked about exposure to occupation-related perceived transgressions committed by the respondent and/or other individuals, or perceived betrayal by others, such as colleagues[1,2,3].

Studies were excluded on the following grounds:

a) The article was a review that did not offer new data or only presented qualitative analysis;
b) Single case studies;
c) Studies not written in English;
d) Studies examining moral distress in nursing and medical professionals.

Two authors (VW & SAMS) independently screened articles and extracted data. A Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow chart (Fig. 1) delineates the review process[13]. On two occasions, the same data were reported in more than one article. In such cases, results from the most comprehensive article were used[14]. The final sample consisted of thirteen studies that met the inclusion criteria.

Data extraction

The following data were extracted from each study, if available: (a) author name; (b) publication year; (c) study design; (d) study location; (e) type of PMIEs; (f) instrument used

to assess the PMIE; (g) sample size; (h) gender distribution; (i) participant age; (j) assessment time points; (k) mental health disorder assessed; (l) mental health instruments/diagnostic criteria used; (m) time since PMIE; (n) findings and effect sizes; and (o) any sources of bias or ethical issues. The data was extracted and assessed independently by two authors (VW & SAMS). Any discrepancies were checked and a consensus successfully reached.

Quality rating

Two authors (VW and SAMS) independently assessed the methodological quality of all included studies using a seven-item checklist adapted from Ajetunmobi[15]. The highest possible quality score was 7, indicative of a better quality study, with 0 as the lowest possible score. Adapted items on the checklist include an evaluation of whether: the study design was evident and appropriate, if random sampling of study participants was used to ensure all members of the examined population had an equal chance of being selected into the sample, and the analytic methods used were well described and appropriate. Studies were scored depending on the extent to which the specific criteria were met ('yes' = 1, 'no' = 0) and we calculated a summary score for each study by summing the total score across all items of the scale (see Table 1 & Supplementary Table 2). Agreement between authors was strong with any disagreements resolved in a consensus meeting.

Data synthesis

The relationship between PMIEs and PTSD, depression, suicidal ideation was examined using meta-analytic methods. The relationship between PMIEs and anxiety and wellbeing (e.g. resilience, hostility, stress, positive affect, social adjustment) was examined descriptively due to insufficient data for meaningful statistical analysis (k<4).

We conducted meta-analyses using Rstudio (version 0.98.507) with the Metafor package[16]. We used Pearson's product-moment correlation (r) as the effect size (ES) as r is more readily interpretable in comparison to other ESs[17,18] and is easily computed from *t, F,*

and *d*. We extracted ES values for each association of interest within each study, with separate ES values for each mental health disorder. Where necessary, correlation coefficients were calculated from other provided ESs (e.g. *F*) or obtained from study authors. Cohen's[19] guidelines were used to interpret the effect sizes (small effect *r*=.10, moderate effect *r*=.30, large effect *r*=.50). Correlation coefficients were computed so that a positive coefficient reflected more severe mental health disorder symptoms, and a negative coefficient reflected less severe mental health disorder symptoms.

Where data regarding the relationship between particular potentially morally injurious events (e.g. transgressions – self, transgressions – others, betrayal) and mental health disorder symptoms was reported, one ES was generated for each study by averaging across all of the PMIEs and mental health comparisons for the study[4,5]. Study ESs by event type can be found in Supplementary Table 3. If studies recruited two samples, but administered a more complete battery of mental health assessments to one particular sample, the data from this sample was used in the analyses (e.g.[5]).

We applied the Hedges-Olkin approach[21] using the Fisher transformed correlation coefficients with the results reported in Pearon's *r* following a back-conversion. We chose random-effects modelling with restricted maximum likelihood *a priori* as this method allows the meta-analytic results to be generalized to a wider population of studies[21,22]. To assess heterogeneity, or the presence of variation in the true effect sizes between studies, Cochran's Q and I^2 statistic were used. Heterogeneity can be clinical (e.g. differences between patients), methodological (e.g. differences in study design), or statistical (e.g. variation between studies in the underlying effects being evaluated)[24]. To assess statistical heterogeneity, we examined the potential presence of moderator variables, with possible clinical and methodological heterogeneity examined descriptively. Heterogeneity was assessed in order to aid

interpretation of the meta-analytic findings as without knowing how consistent the results of studies are it is not possible to determine the generalisability of the results[24].

We conducted moderator analyses on the PMIEs and PTSD, depression and suicide ideation analyses, including variables where there were at least three studies in each sub-category[23]. We individually examined the following variables as potential moderators of the association between PMIEs and mental health: participant age, whether the transgressive act was experienced in a military or non-military context, participant gender, study location (USA vs Other), and whether or not the study utilised a measurement tool that solely examined exposure to potentially morally injurious events or if a tool was used which conflated PMIE exposure with the impact of effects (discussed in the following section). These moderators were chosen for the present analysis as sufficient data ($k \geq 3$) was available to examine their impact on the effects. Meta-regression was used when a moderator was a continuous variable (e.g. participant age) to quantify the relationship between the magnitude of the moderator and the PMIEs – mental health disorder effect[24].

Publication bias of the relationship between PMIEs and each mental health disorder analyses was examined by creating funnel plots to provide a visual representation of the data. Rank correlation tests[25] and regression tests[26] were conducted to determine if there was any evidence of publication bias. Duval and Tweedie's trim and fill procedure was also used to examine the presence of potential publication bias[27].

Study sample

Twelve of the thirteen studies identified were cross-sectional, with one notable exception[7]. Studies were published between 2011 and 2017 and involved a total of 6,373 participants (range n= 60-2095). Most participants were male, with an age range of 22.0 - 64.0 years. The majority of studies examined PMIEs in military samples in relation to military deployment (e.g. feeling troubled by having witnessed others' immoral acts while on

deployment[7], see Table 1). In non-military samples, exposure to moral and/or ethical dilemmas in the workplace were investigated. Studies in non-military samples examined exposure to PMIEs in journalists who covered the 2011 Norway terror attack (e.g. work description included tasks that went against personal values) [8], teachers exposed to community violence in El Salvador (e.g. witnessing actions by other school staff that led to the suffering of students)[28]; veterinarians who experienced morally significant events during in veterinary practice (e.g. performed euthanasia for reasons they do not agree with[29]), and police officers who killed or caused serious injury in the line of duty[9]. Non-validated assessments of workplace PMIEs were used by six studies (see Table 1) with many informed either by theory or previous research of moral injury[28,35], interviews with participants[32] or via focus groups[8,29,63]. Three included studies utilised validated measures of occupation-related trauma exposure as a proxy measure for PMIEs exposure[9,20,30]. Four studies[4,5,7,14] used the Moral Injury Events Scale (MIES)[7] or the Moral Injury Questionnaire-Military Version (MIQ-M)[14] which assess exposure to both potentially morally injurious events (e.g. "I saw things that were morally wrong") as well as emotional outcomes (e.g. "I am troubled by having witnessed others' immoral acts") on the same items. This may confound exposure to PMIEs with the effects of exposure and could impact the reported ESs[2]. Time since PMIEs was often unreported, with a few studies either stating that the participants were still in active military/police service (e.g. [9,20]) or the PMIE related to service in the Vietnam War[30].

Insert Figure 1 & Table 1 about here

Results

PTSD

Twelve studies assessed the relationship between PMIEs and PTSD using a variety of measures, of which 10 reported significant findings (see Table 1). Most studies assessed PTSD symptoms using the Posttraumatic Stress Disorder Checklist (PCL[31]); however, no marked differences in the PMIEs – PTSD association by PTSD measurement tool – were observed. For the PMIEs and PTSD association, the weighted mean ES was 0.30 ($p < 0.0001$, 95% CI 0.20, 0.39). This ES is statistically significant and meets criteria for a moderate effect, suggesting PMIEs accounts for approximately 9.4% of the variance in PTSD. ESs of PMIEs and PTSD ranged between 0.02-0.65, with some of the largest effects found in military samples (see Table 2). A potential outlier was Ferrajão & Oliveira[32] where, although a small, positive relationship between PMIEs and PTSD was found, no significant differences in PTSD symptoms were found between those who did and those who did not report exposure to PMIEs. A non-significant, positive association between PMIEs and PTSD was also observed by Bryan et al.[4], however this effect was small (ES= 0.02).

Heterogeneity analysis was significant, ($Q(11) = 90.4$, $p < 0.0001$; $I^2 = 92.01\%$) and potential moderating variables were examined to determine whether study characteristics accounted for differences in the results[24]. Between-group differences in ES related to study-level moderators were examined using the between-group Q statistic within a random effects model. Results revealed no significant moderator effect on the association between PMIEs and PTSD of participant age (between-group $Q(1) = 0.14$, $p = 0.71$), percentage of male participants in the study ($Q(1)=0.23$, $p=0.62$), whether the PMIE was military vs non-military related ($Q(1)=0.003$, $p=0.95$), whether or not the measurement of PMIEs conflated event exposure with the emotional effects of exposure ($Q(1)=0.08$, $p=0.78$), or study location (USA vs Other, $Q(1)=0.06$, $p=.80$).

No evidence for publication bias was found for the PMIEs and PTSD analysis. Visual inspection, rank correlation ($p=0.84$), and Egger's tests ($p = 0.72$) indicated non-asymmetric

funnel plots. Furthermore, the trim and fill procedure did not suggest the imputation of any studies for this analysis, indicating a lack of publication bias.

Depression

Seven studies assessed the relationship between PMIEs and depression, four of which reported significant findings. Studies largely used the Beck Depression Inventory – 2nd Edition (BDI-II[33]) or The Patient Health Questionnaire-9 (PHQ-9[34]) to assess depression. Pearsons *r* ESs for the association between PMIEs and depression ranged between -0.05-0.40. No marked differences in the PMIEs – depression association were observed based on the depression measure used, although Ferrajão & Oliveira[32] was the only study to examine depression using the depression subscale of the Brief Symptom Inventory[55] and found a particularly small association between PMIE and depression (ES=0.03). All studies examining the relationship between PMIEs and depression were conducted with military samples, with the majority conducted in the US (*k*=6). The mean ES of the PMIEs and depression association was 0.23, meeting criteria for a small effect, and was statistically significant (p = 0.0002, 95% CI 0.11, 0.37). This indicates that PMIEs accounted for 5.2% of the variance in depression. Notably, Bryan et al.[4] found a negative association between PMIEs and depression (overall ES= -0.05) meaning that PMIEs was associated with fewer depression symptoms, although the strength and nature of the PMIEs – depression relationship varied by event type (see Supplementary Table 3).

The results of the heterogeneity analysis were significant ($Q(6) = 39.56$, $p < 0.0001$; $I^2=88.93$). No significant study moderators were found (participant age ($Q(1)=1.39$, $p=0.23$; percentage of male participants ($Q(1)=1.88$, $p=0.17$; whether or not the measurement of PMIE conflated event exposure with the emotional impact of exposure ($Q(1)=0.23$, $p=0.63$)).

No evidence of publication bias was found. The rank correlation (p = 0.77) and Egger's (p = 0.18) tests were not significant and the trim and fill procedure did not

recommend the imputation of any additional studies for this analysis, indicative of a lack of publication bias.

Suicidality

Four studies assessed the PMIEs – suicidality association, three of which reported significant findings. All studies were based in the US and examined PMIEs in a military context. Meta-analysis examining PMIEs and suicidality identified a small, significant mean ES of 0.14 ($p < 0.0001$, 95% CI 0.08, 0.20). This mean ES meets the criteria for a small effect, suggesting that PMIEs is associated with approximately 2.0% of the variance in suicidality. Studies reporting on the relationship between PMIEs and suicidality all utilised military samples, with ESs ranging from 0.13-0.27.

The results of the heterogeneity analysis were non-significant ($Q(3) =1.27$, $p =0.74$; $I^2=0.00$). Given the small number of included studies, a non-significant result cannot necessarily be interpreted as evidence of no statistical heterogeneity as the test may lack power to detect significant heterogeneity when present[24]. Thus, between-group differences in ES related to study-level moderators were examined using a random effects model to ensure the PMIEs – suicidality association was thoroughly explored. No significant moderators of ES were found (age ($Q(1)=0.18$, $p=0.67$); percentage of male participants ($Q(1)=0.01$, $p=0.94$). Other moderators, such as study location, whether the tool used to measure PMIE conflated PMIEs exposure with the emotional effects of exposure, and PMIEs type (e.g. military vs non-military) could not be examined due to insufficient data for a meaningful contrast between subgroups. Only one study used a non-validated measure of PMIEs[14] and reported findings (ES=0.14) which were not inconsistent with other studies that utilised validated measures of PMIE (e.g. [4,30]). No evidence for publication bias was found for the PMIEs and suicidality analysis. Visual inspection, rank correlation ($p=0.33$), and Egger's tests ($p = 0.38$) suggest non-asymmetric funnel plots. The trim and fill procedure did not

recommend the addition of any further studies for this analysis, suggesting a lack of publication bias.

Anxiety

Three studies examined the association between PMIEs and anxiety, thus it was not possible to utilise meta-analytic methods [5,7,29]. One study examined the relationship between PMIEs and anxiety in veterinarians[29], while Bryan et al.[5] and Nash et al.[7] examined military-related exposure to potentially morally injurious events. PMIEs was significantly associated with anxiety symptoms across all three studies (range: 0.16-0.28, see Table 2). The relationship between PMIEs and anxiety was fairly small in the non-military sample[29] which may reflect the nature and/or intensity of the potentially morally injurious events experienced. Bryan et al.[5] found all event types (e.g. transgressions-other, transgressions-self, betrayal) to be significantly, positively associated with anxiety, with the strongest relationship found between anxiety and perceived betrayal (ES=.219; see Supplementary Table 3).

Hostility

Three studies examined the relationship between hostility and PMIEs, all in a military context[5,30,35]. In all studies, PMIEs and exposure to wartime atrocities (e.g. acting in ways that violate one's moral code; hurting, killing or mutilating bodies of civilians and enemy combatants) was positively and significantly associated with hostile behaviour, although some effects were small (Bryan et al.[5] ES= 0.21; Dennis et al.[30] ES= 0.18) [19]. The larger effect reported by Wilk and colleagues[35] (ES=0.41) may reflect the fact that the sample participated in the study during deployment to Iraq in 2007, that a non-validated measure of PMIEs was used, and the non-validated measure of hostility largely focused on aggression towards other unit members (e.g. in the last month have you threatened a unit member with physical violence?).

Resilience, social adjustment and positive affect

The relationship between PMIEs and psychological resilience, or the ability to recover from stressor events in the past four weeks, was examined by Crane et al.[29] using the Brief Resilience Scale (BRS[36]), with a significant negative association found between PMIEs and resilience (ES= -0.17; Table 3). Consistent with this, Crane et al.[29] also found a positive association between PMIEs and self-reported symptoms of stress (ES=0.24).

Nash et al.[7] examined the relationship between military related PMIEs and positive affect and social adjustment. PMIEs was significantly, negatively associated with positive affect (ES=-0.15) and social adjustment (ES=-0.29), indicating that higher levels of PMIEs was associated with less self-reported social support and less positive affect[7]. In keeping with these findings, Ferrajão and Oliveira[32] also found a small, but not statistically significant, negative relationship between perceived social support and PMIEs (ES=-0.03). However, these findings should be interpreted cautiously as Nash et al.[7] used the MIES which confounds PMIE exposure with outomes[3] and Ferrajao and Oliveira[32] used a non-validated PMIE measure.

Insert Tables 2 & 3 here

Discussion

The aim of the present review was to examine the relationship between exposure to potentially morally injurious events incurred as a result of occupation and mental health outcomes. Although based on a relatively small number of articles, the results indicate that a small to moderate relationship between PMIEs and PTSD and depression is evident, although the associations with other mental health symptomology appears less certain.

The strongest relationship was found between PMIEs and PTSD, consistent with previous studies which report that the common symptoms of moral injury are intrusive thoughts, intense negative appraisals (e.g. shame, guilt, disgust, etc.), and reliance on cognitive avoidance as a (maladaptive) coping strategy [1]. The experience of such PTSD symptoms has also been found cross-culturally in qualitative studies of moral injury in war veterans in Zimbabwe[37], where pastoral care was experienced as particularly efficacious in managing intrusive thoughts and negative affect. While study location (USA vs Other) was not found to be a significant moderator in this analysis, included studies were largely conducted in western environments. Additional investigation of the experiences and impact of occupation-related PMIEs in non-western contexts would be useful to further the understanding of cross-cultural differences and similarities in mental health outcomes following PMIEs and how best to support morally injured individuals.

A statistically significant, although small, relationship between depression and PMIEs was found in military personnel, however civilian data on this association was lacking. Characteristic symptoms of depression include social withdrawal, self-depreciating emotions and a loss of meaning[38], all of which have been reported in qualitative studies following military-related moral injury[6]. Similar symptoms of depression and psychological distress has also been reported in qualitative studies of humanitarian aid workers who experience work-related moral challenges (e.g. a lack of resources meaning they cannot provide adequate healthcare to all patients[39,40]).

Suicidality was significantly associated with PMIEs in military personnel with a small effect. However, this relationship may be less reliable as only three studies report significant findings. Alternatively, it is possible that the relationship between suicidality PMIEs may be an indirect effect caused by other associated risk factors or consequences of PMIEs, such as depression or PTSD[4,41,42] and warrants further research.

A modest relationship between PMIEs, anxiety, hostility, poor resilience and less social support was also examined in the present review. The relationship between PMIEs and hostility is in keeping with recent research of military-related PMIEs causing anger or hostility that persists for several years post-deployment, even after controlling for PTSD symptoms[43]. Nonetheless, additional investigation is required to explore the PMIEs - hostility relationship in non-military contexts.

Taken together, the results suggest a negative impact of PMIEs on psychological adjustment, in both a military and non-military occupational context. However, PMIEs only accounted for a modest proportion of the variance in PTSD, depression and suicidality. It may be valuable for future studies to consider other risk factors and instrumental moderator variables for such psychological adjustment difficulties. Given the lack of a widespread, substantial impact on mental health, it also may be of interest to consider whether exposure to potentially morally injurious events might be linked to other outcomes both in terms of practical (e.g. resigning from one's work) or positive change (e.g. posttraumatic growth).

Strengths and limitations

The results of this study must be considered in light of the limitations. First, most included studies examined PMIEs in a military context (k=10). Other occupational groups, including firefighters, relief aid workers, and social workers, are exposed to traumatic and potentially morally injurious events and additional research is needed to fully understand the impact of such stressors on their mental health and wellbeing. Second, all studies measured exposure to PMIEs using self-report measures, many of which were not validated[8,28,29,32,63]. Several studies also used measures of PMIEs that have methodological issues[2] (e.g. confounding exposure to transgressive events with exposure effects[4,5,7,14]), although this was not found to be a significant moderator for the PTSD and depression analyses. In some cases a proxy measure of PMIEs, such as exposure to war time atrocities[30], was used which

highlights the lack of consistency in the literature of the types of events that can cause moral injury. Nonetheless, to further our understanding of the impact of PMIEs on mental health, a valid and reliable assessment of PMIEs and moral injury outcomes is required. Third, this review was not pre-registered on PROSPERO or a similar register. Finally, the majority of studies included in this review examined PMIEs in a USA or western context (e.g. Norway, Australia), with a few notable exceptions (e.g. Israel, El Salvador) and additional research in non-western, low or middle income countries (LMIC) is needed.

Clinical implications

The present findings indicate that occupational PMIEs can potentially have an, albeit small, impact on the mental health of both military and civilian personnel. Importantly, this suggests that moral injury is not a concept which is only relevant within a military context and can potentially be experienced in other occupational settings - although additional research in non-military samples is recommended to more fully understand this experience. What evidence there is suggests that individuals who experience PMIE may be at risk of PTSD and depressive disorders. Previous reviews suggest that some treatment approaches for these disorders may be insufficient in cases of moral injury[6]. Treatment for PTSD, for example, may not adequately address all negative sequelae present in those with moral injury. Future research exploring the impact of PMIEs on psychopathology over time, as well as randomised control trials directly evaluating treatment approaches following PMIEs would be beneficial.

Directions for future research

This review suggests a number of additional areas for exploration that may prove beneficial for our understanding of moral injury. Whilst the evidence regarding the mental health outcomes of PMIEs appears to be at most modest, what seems particularly clear is that there is a lack of high-quality evidence published on this topic. This in part may reflect the

fact that moral injury is a relatively emerging concept[1,2] and there is a need for considerably more research, including the design and validation of assessments that measure the impact of PMIE exposure as well as the outcomes of moral injury. As it stands, some existing measures do not include exposure to a variety of potentially morally injurious events or confound PMIE exposure with the psychological effects of exposure[2,3]. The development of high-quality measurement tools would allow for reliable investigations into the existence and prevalence of moral injury in both military and non-military environments and would further our theoretical understanding of whether moral injury is a distinct concept. This line of research could also aid in exploring whether there are particular experiences that are more likely to cause moral injury as well as the precursors and the factors associated with vulnerability or resilience following moral injury. As not all individuals who experience trauma necessarily develop PTSD, exposure to PMIEs may similarly not always result in moral injury and additional research is needed to better understand PMIE outcomes. For example, the pernicious effects of moral injury may depend on one's appraisal of the transgressive act and the coping strategies employed.

In the wider literature, previous studies in healthcare professionals have found years of occupation experience to be significantly positively associated with moral distress, contributing to staff burn out and resignation[10,11]. Although moral distress differs from moral injury in that the conditions in which it can be experienced are often more limited (e.g. healthcare professionals are prevented from acting on their judgement of the right thing to do largely by institutional restraints, such as pressure to minimise costs[46]); nonetheless, it is possible that factors contributing to poor mental health outcomes following moral distress may be applicable in cases of moral injury and should be pursued further.

Although only examined by two studies, exposure to specific potentially morally injurious events (e.g. transgressions-other, transgressions-self, betrayal) were differentially

associated with mental health[4,5] (Supplementary Table 3). One study[5], found a particularly strong relationship between perceived betrayal and mental health difficulties. As this sample had very recently returned from deployment to Afghanistan, this type of potentially morally injurious event could be more salient to participants when responding to study measures. This highlights the need for moral injury to be examined as a function of PMIE type and time since event to better understand moral injury.

Conclusions

This paper presents a comprehensive review and meta-analysis of the relationship between exposure to occupational-related potentially morally injurious events and mental health in both military and non-military connected personnel. We found small yet significant associations between PMIEs and PTSD and depression. A less reliable relationship between PMIEs, anxiety, hostility and suicidality was also observed. Given the limited number of high-quality studies available, only tentative conclusions about the association between PMIEs and mental health disorders can be made at this stage. This study highlights that considerably more research is needed in the field of moral injury, including the development of valid assessments of the impact of PMIEs exposure and outcomes. We suggest that additional investigations, particularly in relevant non-military connected populations, and other influential moderators and outcomes are considered in future research into moral injury.

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Table 1
Included studies sample characteristics, methods of assessment, and quality ratings

Study	Location	Design	*N*	Males (%)	Age (SD)	Exposure	Wellbeing measured	PMIEs measurement	Quality rating
Bakcholm & Idas, 2015	Norway	Cross-sectional	371	59.6	36.03 (10.09)	Journalists covering 2011 Norway terrorist attack	PTSD (IES-R)	3-item questionnaire	5
Bryan et al., 2014[a]	USA	Cross-sectional	151	63.8	34.12 (8.41)	Afghanistan/Iraq deployment	Suicidal ideation (BSSI), PTSD (PCL-M), depression (PHQ-9)	MIES	5
Bryan et al., 2016[a]	USA	Cross-sectional	935	82.3	27.05 (8.11)	Afghanistan/Iraq deployment	Suicidal ideation (BSSI), PTSD (PCL-M), depression (PHQ-9), anxiety (GAD-7), hostility (STAXI-2)	MIES	6
Crane et al., 2015	Australia	Cross-sectional	540	35.8	41.06 (11.53)	Veterinary practice	Depression, stress & anxiety (DASS-21), resilience (BRS)	Stressor checklist	4

Currier et al., 2015a[b]	USA	Cross-sectional	213	88.0	28.47 (5.87)	Afghanistan/Iraq deployment	Suicidal ideation (SBQ-R), depression (PHQ-9), PTSD (PLC-C)	MIQ-M	5
Currier et al., 2015b	El Salvador	Cross-sectional	257	31.4	42.02 (13.12)	Community violence	PTSD (LASC)	MIQ-T	5
Dennis et al., 2017	USA	Cross-sectional	603	100.0	51.0 (5.71)	Vietnam war	Suicidal ideation (SBQ-R), PTSD (PLC-C), depression (PHQ-9), hostility (CMHS)	VESI	4
Ferrajão & Oliveira, 2014	Portugal	Cross-sectional	60	100.0	64.0 (N/A)	Portuguese war veterans	PTSD (IES-R), depression (BSI)	Interview	4
Komarovskaya, et al., 2011	USA	Cross-sectional	400	85.0	27.0 (4.81)	Killing/seriously injuring others during police service	PTSD (MCS-CV), social adjustment (SAS-SR)	CIHQ	4
Nash et al., 2013	USA	Longitudinal	533	N/A	22.67 (3.50)	Afghanistan/Iraq deployment	PTSD (PCL), anxiety (BAI) depression	MIES	5

							(BDI-II), positive affect (PANAS), social adjustment (ISEL)		
Ritov & Barnetz 2013	Israel	Cross-sectional	147	100.0	27.45 (3.67)	Combat service in West Bank/Gaza Strip	PTSD (unnamed)	Moral objection	4
Tripp et al., 2016[a]	USA	Cross-sectional	68	91.0	32.3 (8.84)	Afghanistan/Iraq deployment	PTSD (CAPS), depression (BDI-II), suicidal ideation (SSI)	DDRI	3
Wilk et al., 2013	USA	Cross-sectional	2095	91.0	n/a	Afghanistan/Iraq deployment	PTSD (PCL), hostility (unnamed)	BEB	5

Note: *N*= total number of participants. SD= standard deviation. a= ES calculated by averaging across all moral injury (transgressions – self, transgressions – others, betrayal) and mental health comparisons for this study. b= Demographic information only provided for 131 participants. Males(%) = percentage of male participants in the study. Age is reported in mean years, standard deviation reported in brackets. Quality= methodological quality score (range = 0-7). PTSD= posttraumatic stress disorder. N/A= not available. BSSI= Beck Scale for Suicide Ideation [47]. PLC-C= Posttraumatic Stress Disorder Checklist—Civilian version[31]. PCL-M= PTSD Checklist, Military Version [31]. PHQ-9=The Patient Health Questionnaire-9 [34]. SBQ-R= Suicidal Behaviours Questionnaire[48]. IES-R= Impact of Event Scale-Revised [49]. GAD-7= Generalized Anxiety Disorder 7-Item Scale[50]. STAXI-2= State-Trait Anger Expression Inventory–2[51]. BRS= The Brief Resilience Scale[36]. DASS-21= Depression,

Anxiety and Stress Scale[52]. LASC= Los Angeles Symptoms Checklist[53]. CMHS= Cook-Medley Hostility Scale[54]. BSI= The Brief Symptom Inventory[55]. BDI-II= The Beck Depression Inventory – 2nd Edition[33]. MCS-CV= The Mississippi Combat Scale – Civilian Version[56]. SAS-SR= The Social Adjustment Scale – Self Report57. BAI = Beck Anxiety Inventory[58]. PANAS= The Positive and Negative Affectivity[59]. ISEL= Interpersonal Support Evaluation List[60]. CAPS= The Clinician-Administered PTSD Scale[61]. SSI= Scale for Suicide Ideation[62]. PMIEs = potentially morally injurious experiences. 3-item questionnaire = three items used to measure potential moral injury event exposure relating to work tasks during the 2011 Norway terror attack informed by previous qualitative studies. MIES = Moral Injury Event Scale[7] which measures potential moral injury event exposure related to three factors (transgressions-other, transgressions-self, betrayal). Stressor checklist = checklist of morally significant stressor events identified via focus groups with veterinarians. MIQ-T = Moral Injury Questionnaire Teacher version, non-validated, 12-item scale of potential moral injury event exposure to assess teacher's exposure to workplace violence (e.g. mistreatment of students; unable to prevent harm to students) and ethical dilemmas informed by theory and previous research of moral injury in other samples. MIQ-M = Moral Injury Questionnaire Military version, measure of potential moral injury event exposure during deployment based on previous theory and research of moral injury; an aim of this study was to validate the MIQ-M[14]. VESI = six items from the Vietnam Era Stress Inventory[64] used to examine involvement in war-time atrocities (e.g. directly or indirectly involved in hurting, killing or mutilating the bodies of civilians and soldiers). Interview = participants interviewed regarding morally injurious experiences with data coded when perpetration, witnessing, or failing to prevent acts that transgressed veterans' moral beliefs was verbalised. CIHQ = The Critical Incident History Questionnaire[65] with indices relating to killing/causing serious injury to others in the line of duty used to assess potentially morally injurious

event exposure. Moral objection = non-validated questionnaire of potentially morally injurious event exposure informed by focus groups of combatants with experience of combat exposure in the West Bank and Gaza. DDRI = Deployment Risk and Resilience Inventory[66] with items relating to firing a weapon and killing an enemy used to measure potentially morally injurious event exposure. BEB = Battlefield ethical behaviours, a non-validated 3-item questionnaire regarding unethical behaviour during deployment informed by previous research and expert opinion.

Table 2
Relationship between mental health and PMIEs

Study	PTSD (ES)	Depression (ES)	Suicidality (ES)	Anxiety (ES)
Bakcholm & Idas, 2015	.36***			
Bryan et al., 2014	0.02	-0.05	.13	
Bryan et al., 2016	.22***	.20***		.16***
Crane et al., 2015				.18***
Currier et al., 2015a	.65***	.39***	.14*	
Currier et al., 2015b	.26***			
Dennis et al., 2017	.33***	.27***	.13**	
Ferrajão & Oliveira, 2014	.23	.03		
Komarovskaya, et al., 2011	.28***			
Nash et al., 2013	.28***	0.40***		0.28***
Ritov & Barnetz 2013	.24***			
Tripp et al., 2016	.42***	0.19	0.27*	
Wilk et al., 2013	.18***			

Note. PMIEs = potentially morally injurious experiences. ES= Pearson's *r*. *p<.05, ** p<.01, *** p<.001

Table 3
Wellbeing and PMIEs

Study	Social adjustment	Positive affect	Stress	Hostility	Resilience
Crane et al., 2015			.24***		-0.17***
Dennis et al., 2017				.18***	
Bryan et al., 2016				.21***	
Ferrajão & Oliveira, 2014	-.03				
Nash et al., 2013	-.29***	-.15***			
Wilk et al., 2013				.41***	

Note. PMIEs = potentially morally injurious experiences. ES= Pearson's *r*. *p<.05, ** p<.01, *** p<.001